2019 Update on the Status of the Eastern Plume

New Cassel/Hicksville Groundwater Contamination Site

Operable Unit 1

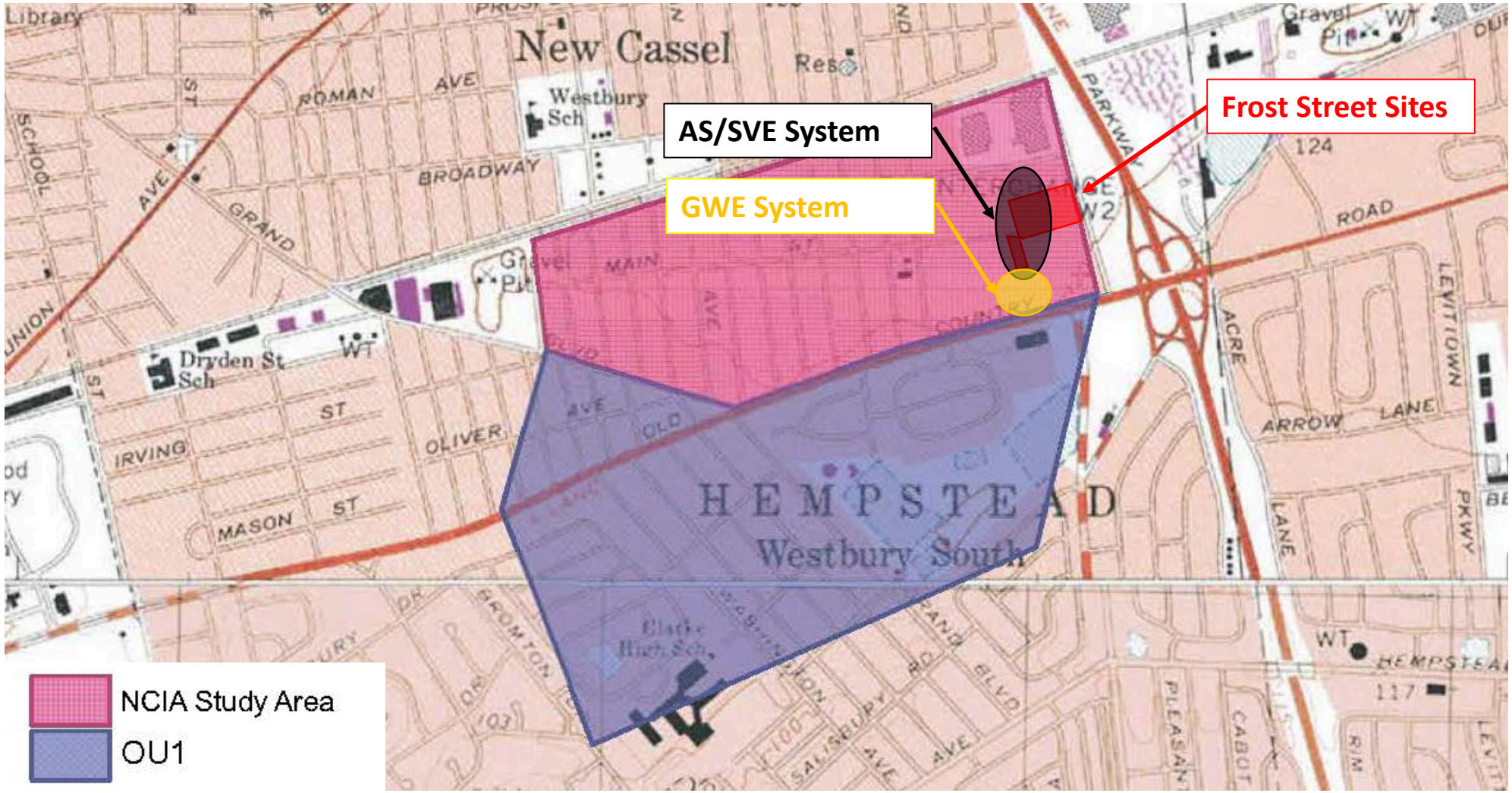
Introduction and Background

- The Record of Decision (ROD) for the New Cassel/Hicksville Groundwater Contamination Superfund Site was signed in September 2013.
    - The remedy was based on data collected through 2011.

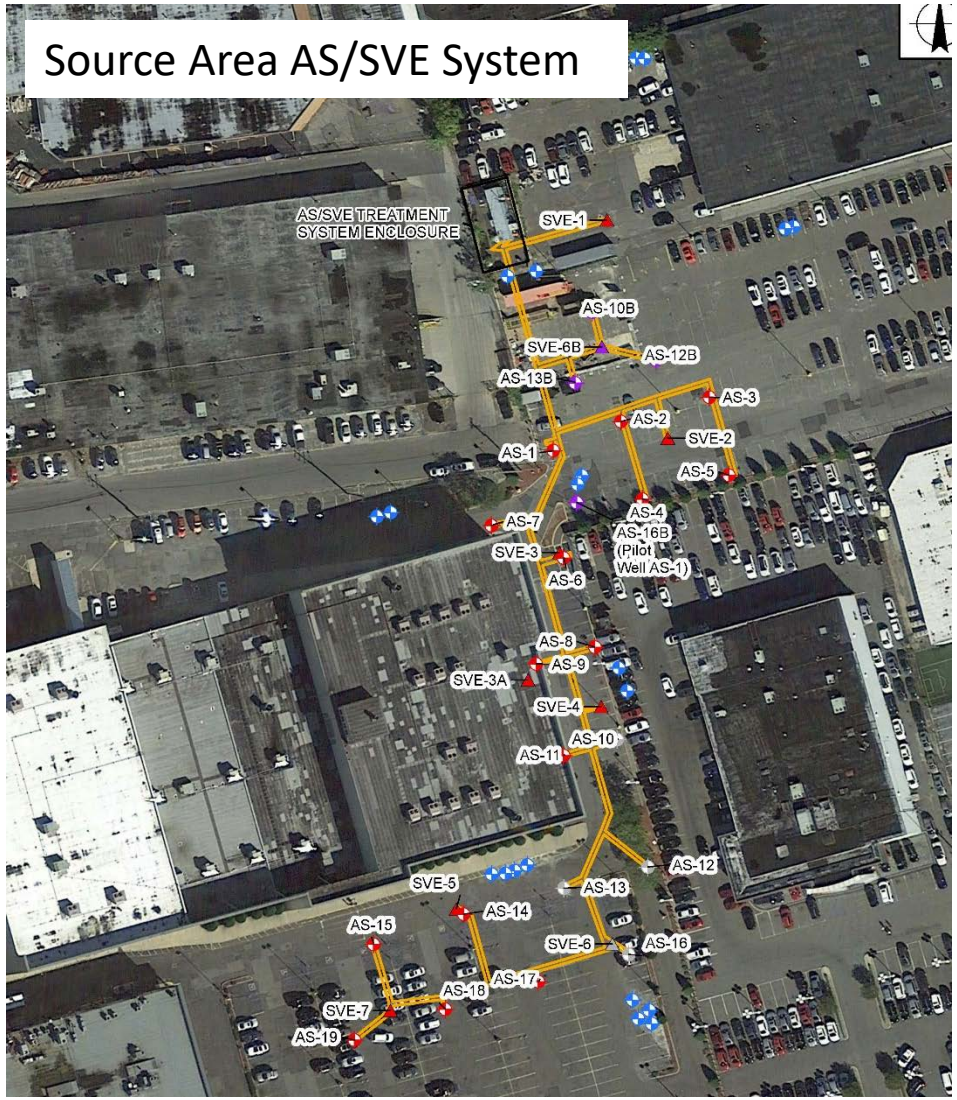
- The Frost Street Sites are considered the source of the Eastern Plume of the New Cassel/Hicksville Groundwater Contamination Superfund Site.

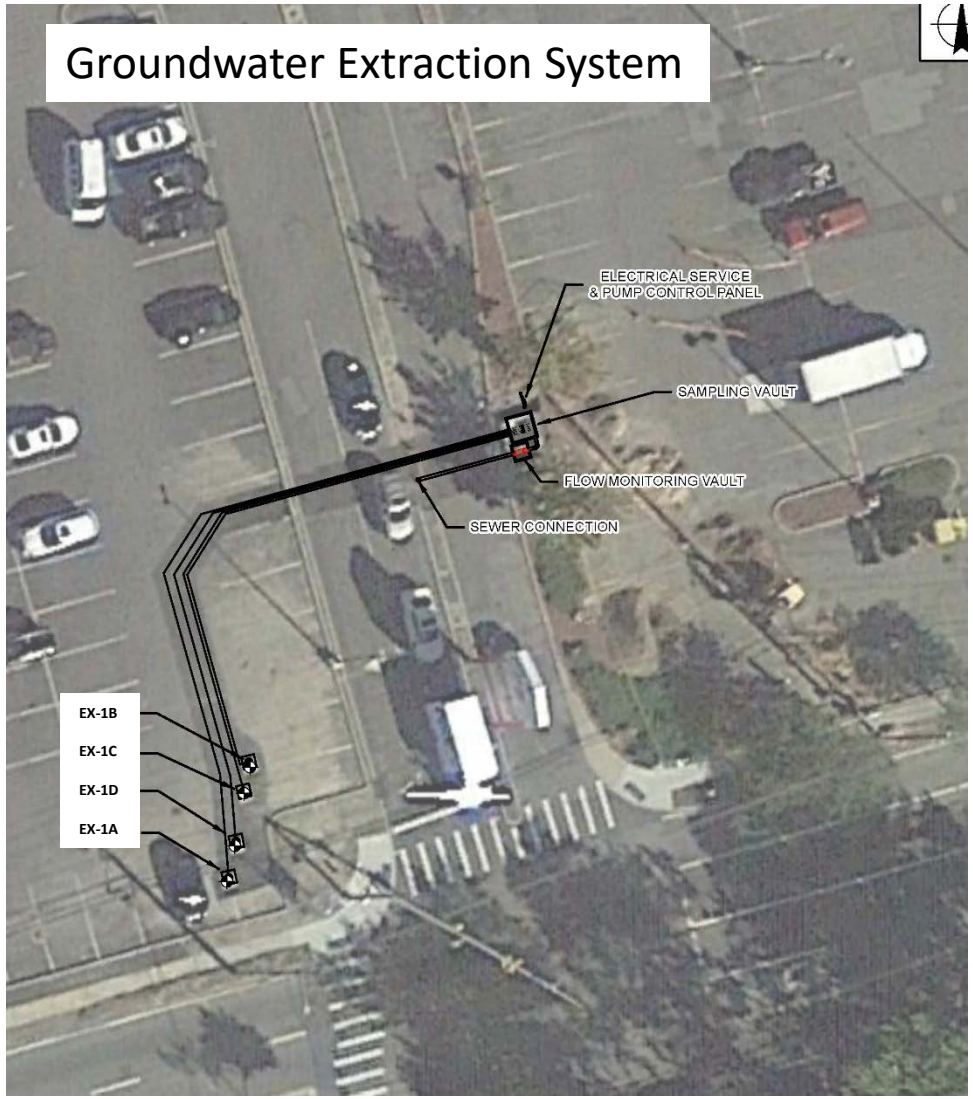
- Under NYSDEC oversight, the Frost Street Parties have implemented, maintained, and monitored soil and groundwater remedial systems at the Frost Street Sites since 2005.
    - Air Sparge/Soil Vapor Extraction (AS/SVE) System
        - In operation since 2005
        - Optimized in 2015
    - Groundwater Extraction System (located at Old Country Road, just upgradient of U.S. EPA OU1)
        - In operation since 2018

Frost Street Active Remedial Systems



Frost Street Active Remedial Systems





2017/2018 Extraction System Installation

- Profile boring installed to 240 feet bgs (July 2017); full results were sent to U.S. EPA in August 2017.
- Apparent zone below MCLs/non-detect between ~150 and 220 feet bgs
- Above 150 feet bgs: PCE dominance (Frost Street)
- Below 220 feet bgs: TCE dominance with carbon tetrachloride and toluene (Upgradient Source)
- Highest concentration at 75-77 feet bgs
  - PCE: 67 ppb
  - TCE: 9.9 ppb

2017/2018 Extraction System Installation

- Extraction wells installed in 2017; four wells screened continuously from 50 to 240 feet bgs
- System is currently operational preliminary, conservative design rates (EnSafe-calculated rates then required by DEC to have a 1.5x design factor)
  - 50-100 feet bgs 30 gpm
  - 100-150 feet bgs 30 gpm
  - 150-200 feet bgs 48 gpm
  - 200-240 feet bgs 48 gpm
- Extensive pump test performed to confirm capture zones in Spring 2018; details provided later in presentation

Current Site Conditions

- Since the data was collected for the U.S. EPA ROD, the Frost Street remedial systems have been in operation.
- Operation and optimization of these systems have contained the source area soil and groundwater contamination and dramatically reduced downgradient groundwater concentrations both onsite (Frost Street Sites) and offsite (U.S. EPA OU1, Eastern Plume).
- This reduction in groundwater concentrations highlights the need for a discussion about the status of, and selected remedy for, the Eastern Plume of U.S. EPA OU1 given the time that has elapsed since the ROD was signed.
- The Frost Street Parties performed an extensive pumping test and modeling effort in Spring 2018 which provided us a new understanding of the aquifer and how it behaves under pumping conditions. Site conditions as understood were validated through numerical modeling based on aquifer response.

New Aquifer Understanding

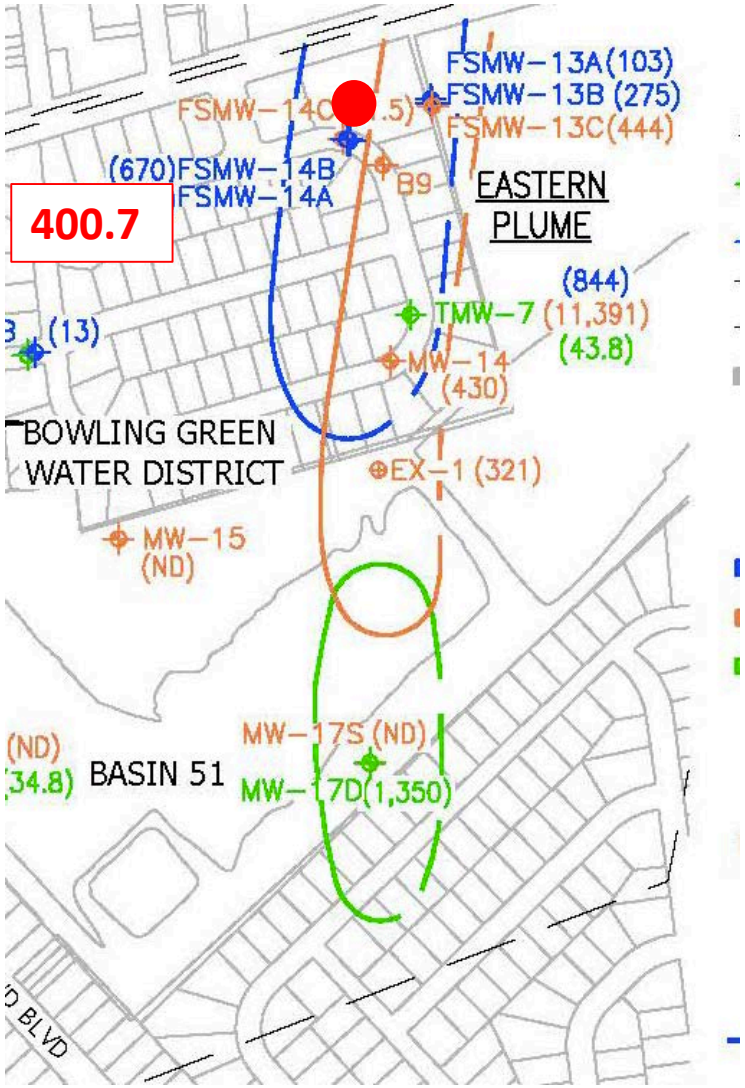
- Extensive pump test performed to confirm capture zones in Spring 2018. which has yielded a new conceptual site model for the site and the local aquifer which suggests the proposed remedy presented in the U.S. EPA ROD should be reevaluated.
- Model indicates effects of NYSDEC OU2 groundwater extraction system extend well into U.S. EPA OU1, overlapping the shallow and intermediate extraction wells envisioned in the ROD
- Vertical component of pumping is larger than originally thought
- Lower conductivity values, and stratification of those values, indicate slower rate of plume migration, but the toe of the Eastern Plume is likely south of the southern boundary of U.S. EPA OU1

Current Site Conditions – U.S. EPA OU1

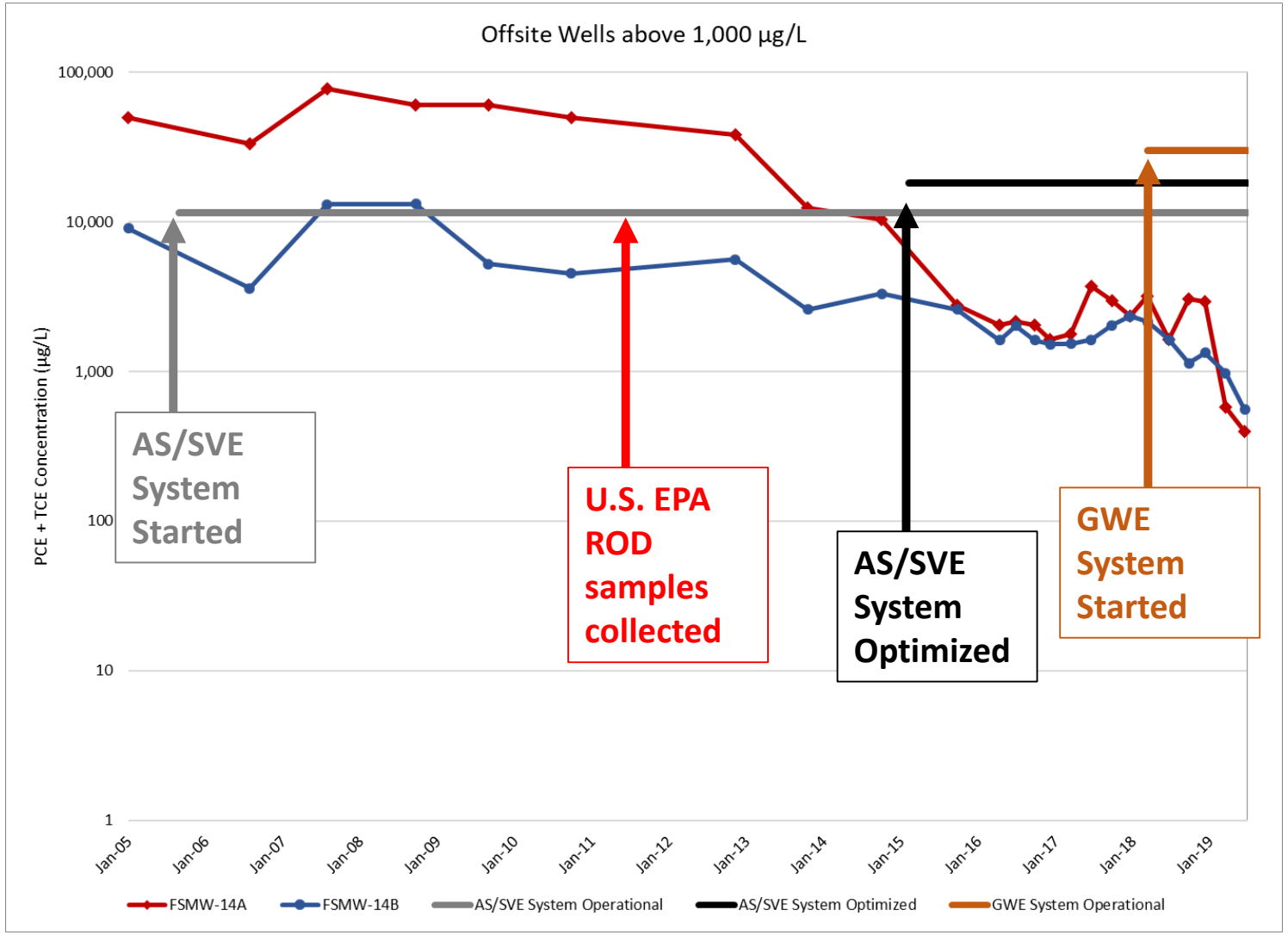
- Historically, high concentrations (>1 ppm) of PCE and TCE have been detected in well cluster FSMW-14, in the northern portion of U.S. EPA OU1.
  - Presence and ratio of PCE/TCE were indicative of Frost Street Site-related contamination.
  - Combined concentrations of PCE and TCE during U.S. EPA's April 2011 sampling event, the basis of the OU1 ROD, were highest at FSMW-14A at 17,800 µg/L.
- The Frost Street Parties have performed quarterly and annual sampling of the FSMW-14 monitoring well clusters since 2005 and saw similar elevated results in 2011 quarterly sampling events.
  - The U.S. EPA data from 2011 does show some improvement from the AS/SVE system operation: the highest concentrations in FSMW-14A (75,000 µg/L) and FSMW-14B (13,000 µg/L) were seen in 2007, just after to AS/SVE system start up.
- Subsequent to this data, the AS/SVE system, which began operation in 2005 was optimized in 2015, and the groundwater extraction system installed in 2018, which have dramatically improved groundwater concentrations at these wells.

Current Site Conditions – U.S. EPA OU1

- Q1 2019 sampling event: PCE + TCE concentrations at FSMW-14A and FSMW-14B dropped below 1,000 µg/L for the first time; further reductions were seen in Q2 2019.
  - Demonstrates the successful performance of the two existing systems in decreasing detectable levels of PCE and TCE in the northern portion of U.S. EPA OU1.
- Decrease in downgradient groundwater concentrations is likely a result of the multi-faceted impact of the pumping wells:
  - Enhanced recovery of dissolved contaminants, “back capture”
  - Desorption of contamination from the aquifer, which is in addition to an overall reduced mass of contaminated groundwater emanating from the source area on the Frost Street Sites due to successful AS/SVE system operation.



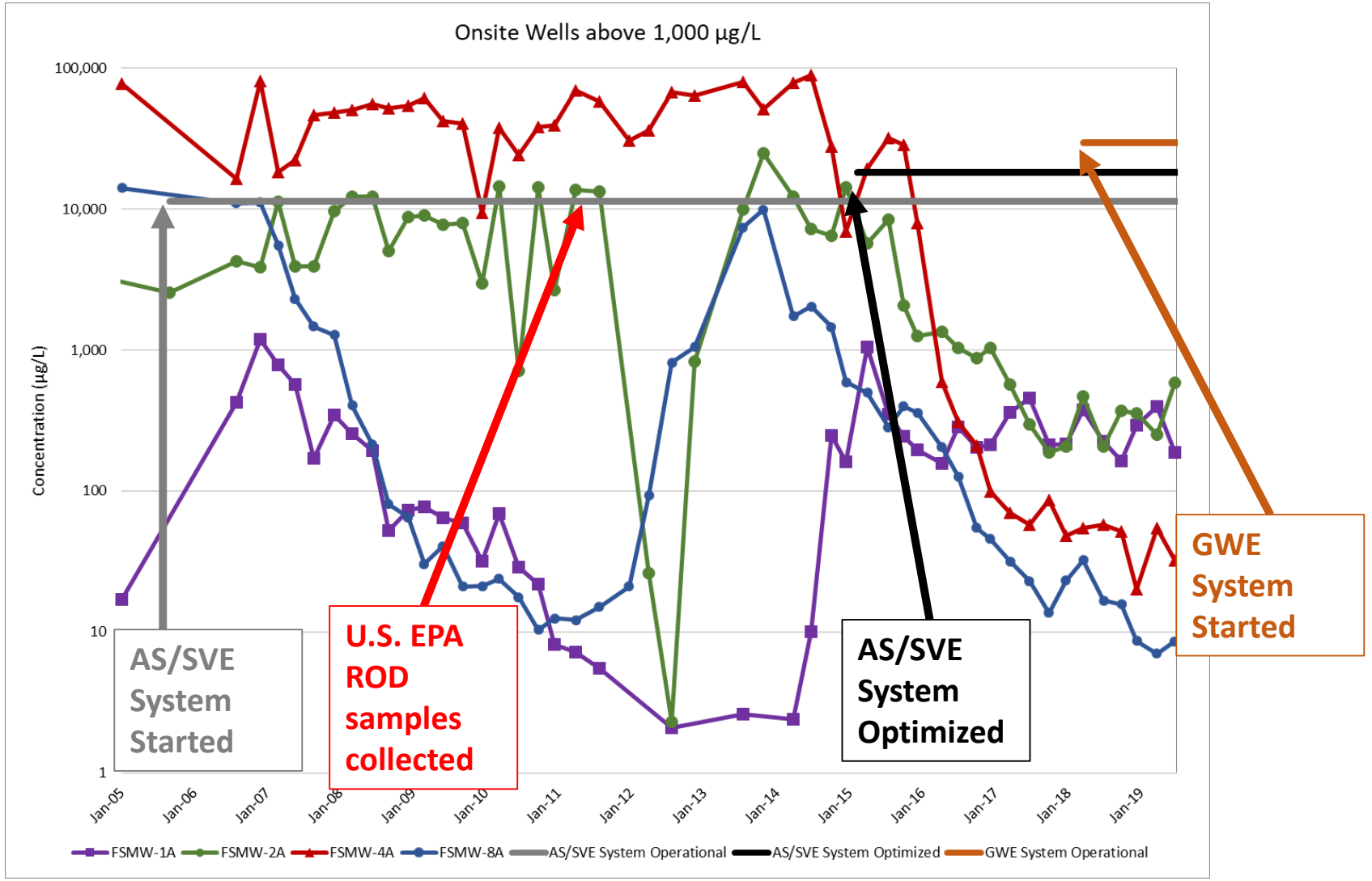
Current Site Conditions – U.S. EPA OU1



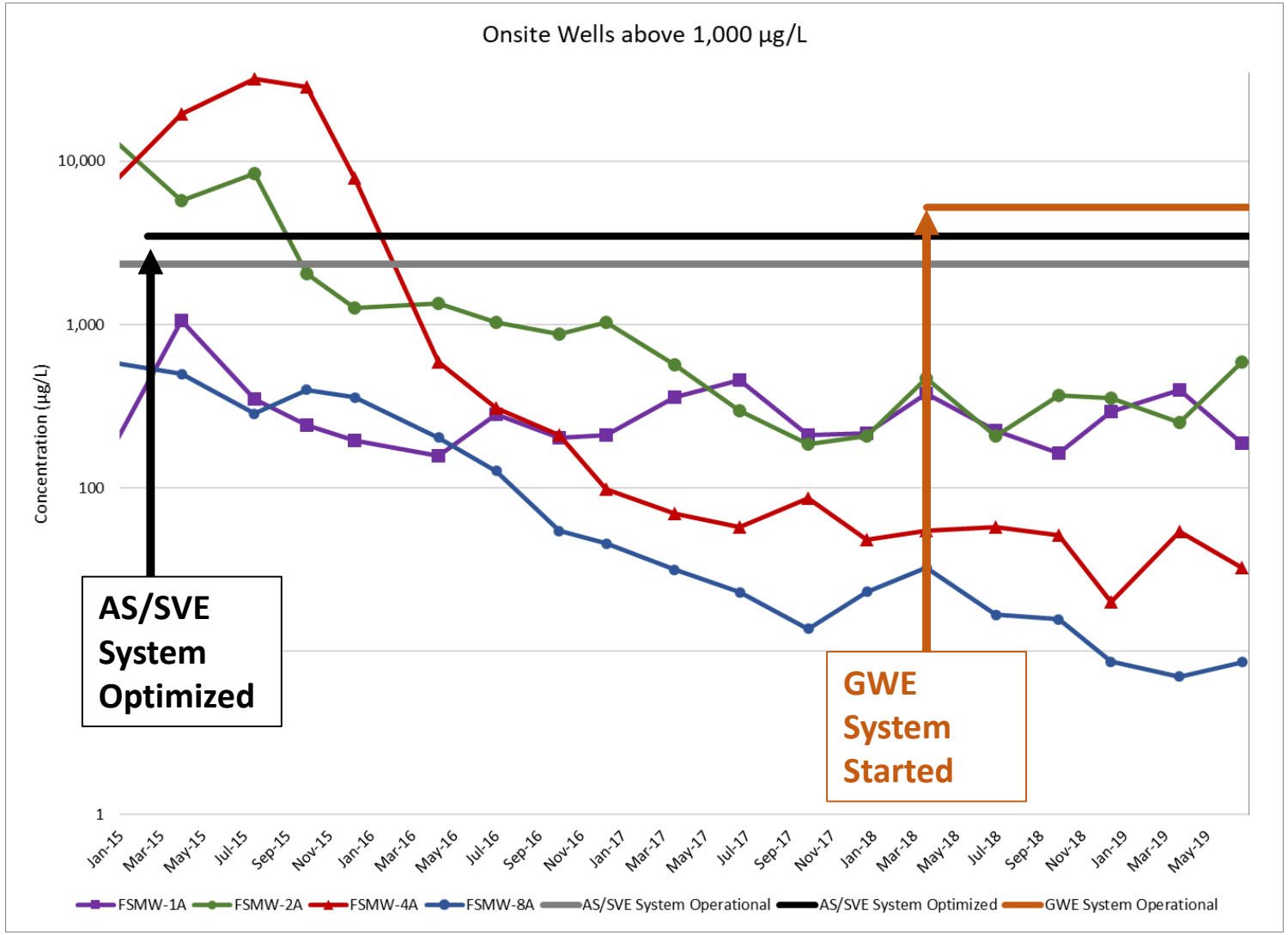
Current Site Conditions – Source Area

- In addition to downgradient offsite wells, wells located on the Frost Street Sites—within or proximal to the source area—also have shown dramatic improvement and reduction in groundwater concentrations.
- During the Q2 2019 sampling event, combined PCE and TCE concentrations are below 600 µg/L for all wells following years of decline after AS/SVE system operation (2005) and optimization (2015).
- This further demonstrates the successful performance of the AS/SVE system in decreasing detectable levels of PCE and TCE by nearly 99% in select source area wells.

Current Site Conditions – Source Area

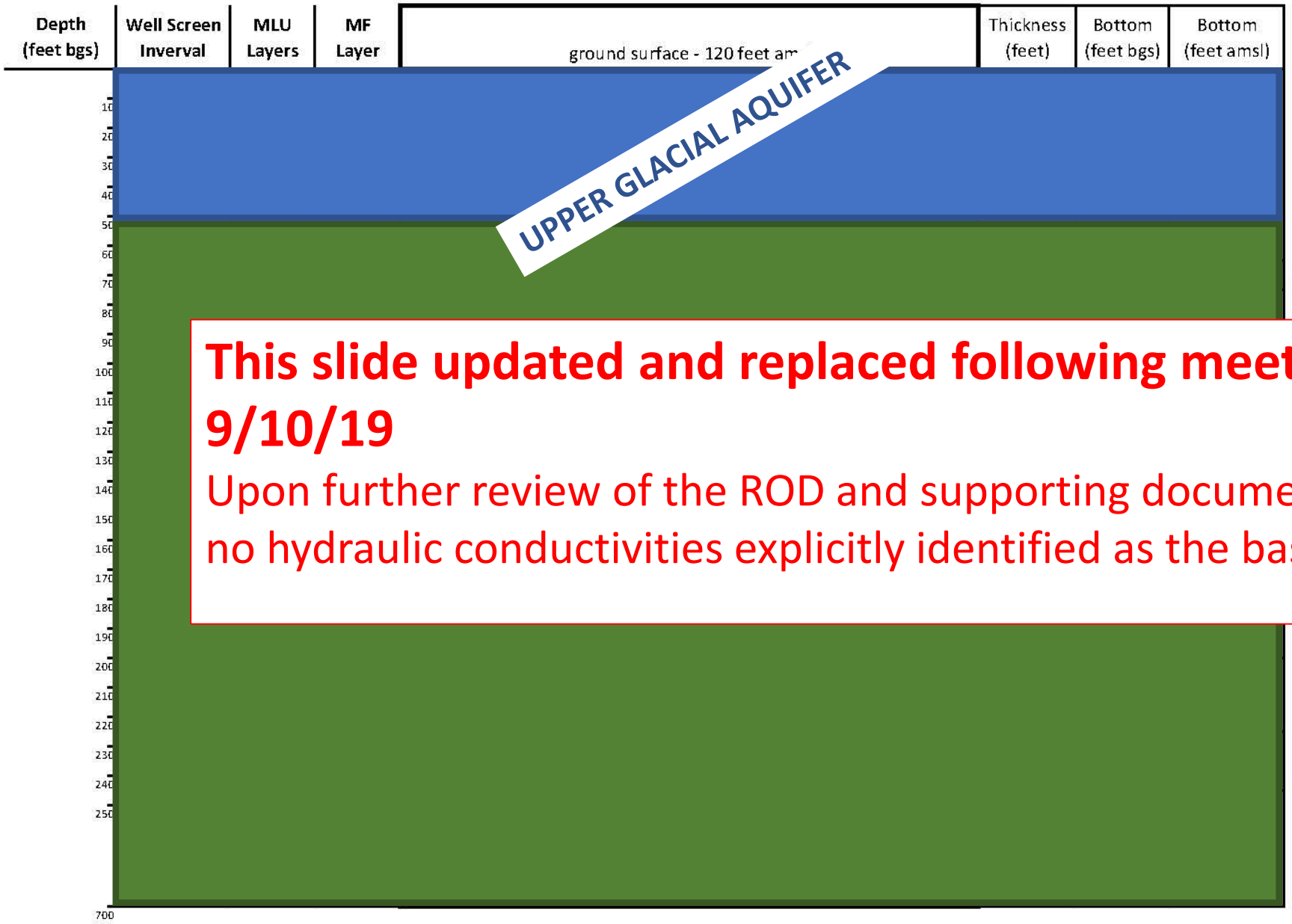


Current Site Conditions – Source Area



Geologic and Aquifer Information

- In spring 2018, the Frost Street Parties performed an extensive pumping test over 11 weeks to evaluate the aquifer and its performance under pumping conditions.
  - Performed to collect and refine aquifer parameters and characteristics with the ultimate goal of optimizing the extraction flow rates to those required to achieve successful capture of the Frost Street plume, while minimizing the extraction of uncontaminated peripheral groundwater.
- Each of the four well intervals were pumped at various configurations to determine the most optimal pumping scenario.
  - Determined that measurable vertical influence can be seen when pumping in other intervals of the aquifer, thereby reducing flow rates and requiring only two of the four intervals (50 to 100 and 150 to 200 feet bgs) to be pumped to achieve the required lateral capture throughout the entire targeted vertical zone (50 to 240 feet bgs).



2013 ROD Understanding of Aquifer

U.S. EPA ROD assumed horizontal K_h for UGA = 70 feet/day

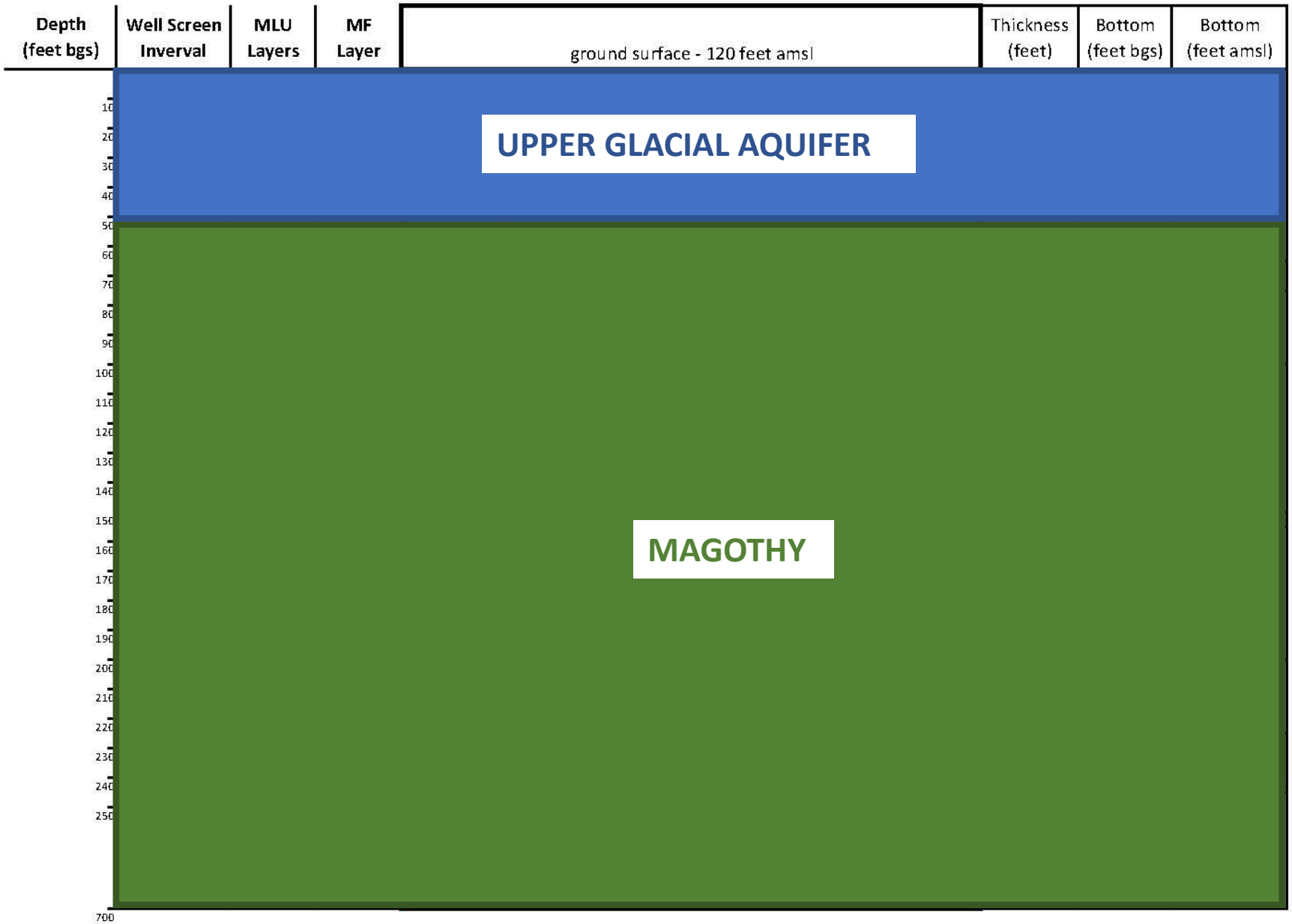
"Fairly isotropic", so vertical K_v for UGA = 70 feet/day

This slide updated and replaced following meeting on 9/10/19

Upon further review of the ROD and supporting documents, there are no hydraulic conductivities explicitly identified as the basis of design.

ned horizontal K_h feet/day

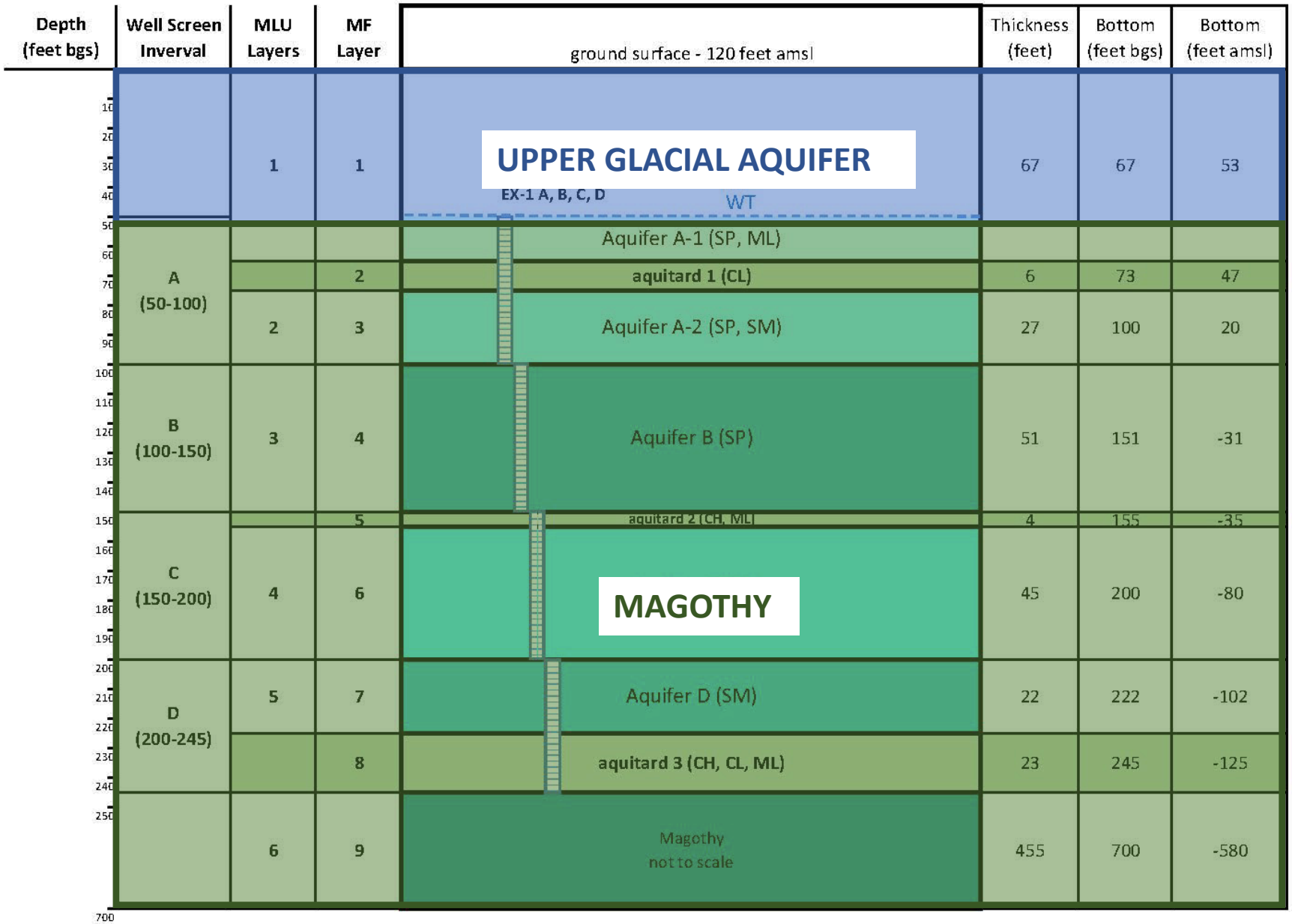
With anisotropies 27-100, so vertical K_v for Magothy = 2.5 to 9.3 feet/day



Prior Understanding of Aquifer

“Fairly isotropic”

Anisotropies 27-100



Current Understanding of Aquifer

UGA is much less conductive than ROD presents

1 - K_h = 0.98 feet/day K_v = 2.54 feet/day

Magothy is far more complex and far less anisotropic

2 - K_h = 1.6 feet/day K_v = 1.6 feet/day

3 - K_h = 7.65 feet/day K_v = 29.81 feet/day

4 - K_h = 52.89 feet/day K_v = 29.81 feet/day

5 - K_h = 0.58 feet/day K_v = 0.58 feet/day

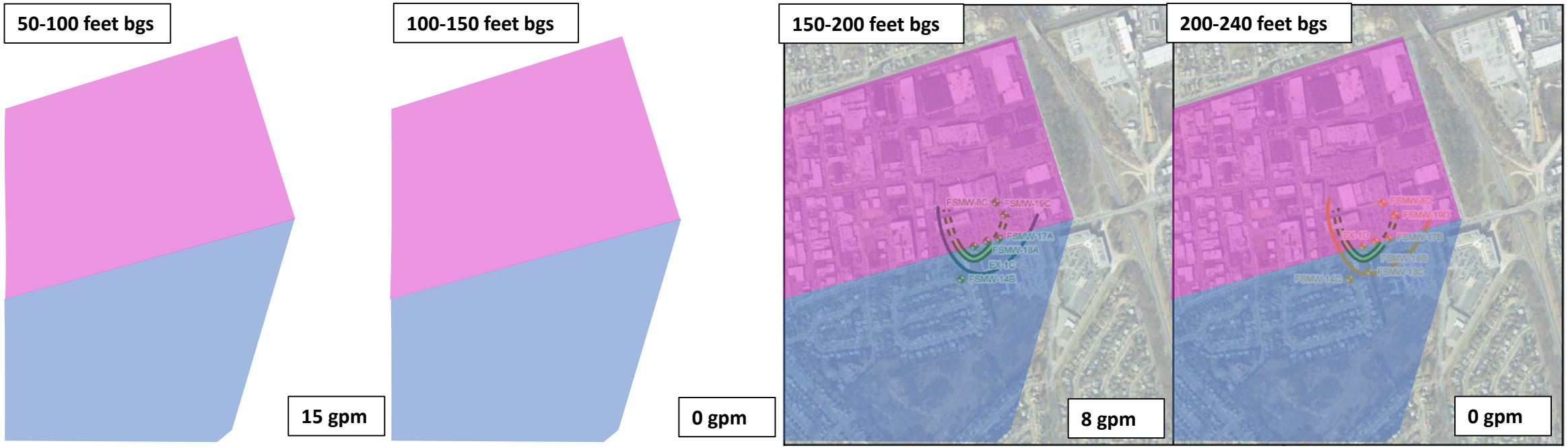
6 - K_h = 26.57 feet/day K_v = 15 feet/day

7 - K_h = 34.95 feet/day K_v = 15 feet/day

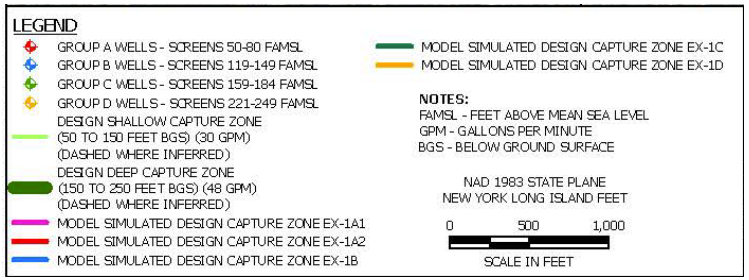
8 - K_h = 0.003 feet/day K_v = 0.003 feet/day

9 - K_h = 50 feet/day K_v = 25 feet/day

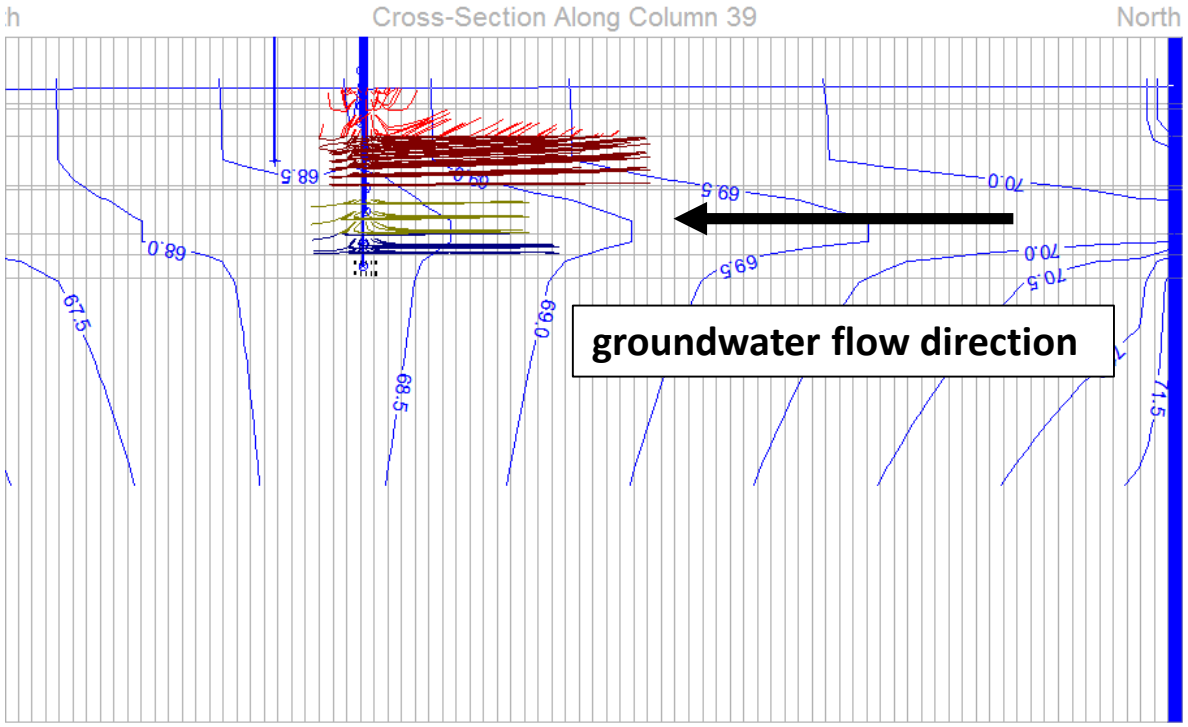
Geologic and Aquifer Information

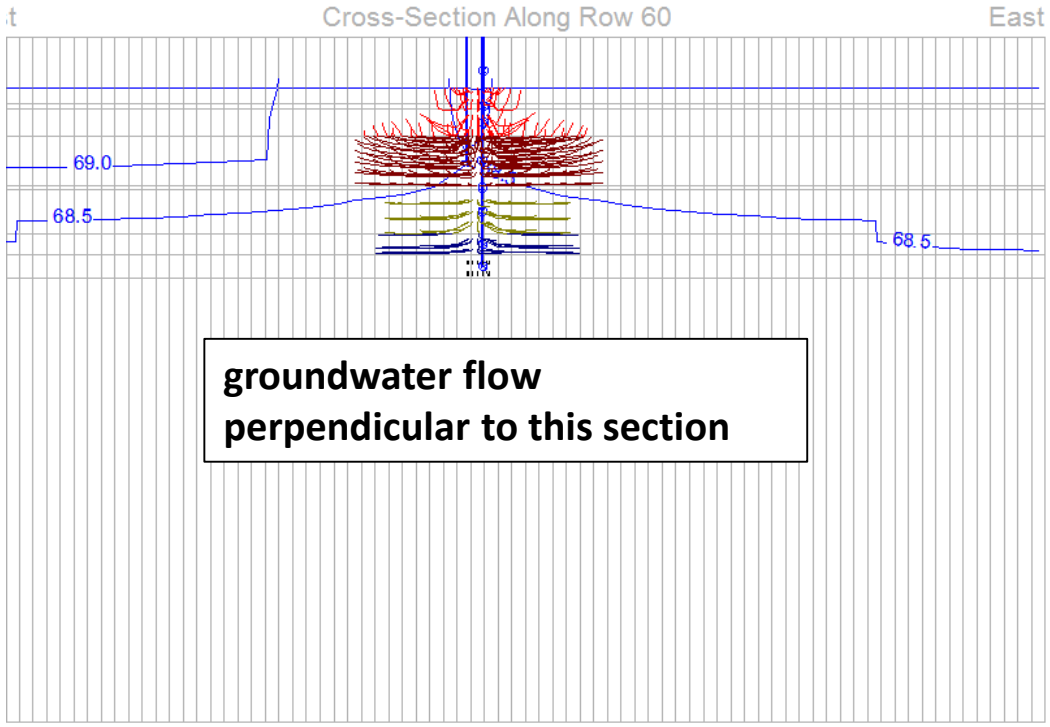


These capture zones are achieved by pumping at the recommended rates, determined from the pump test and subsequent groundwater model.

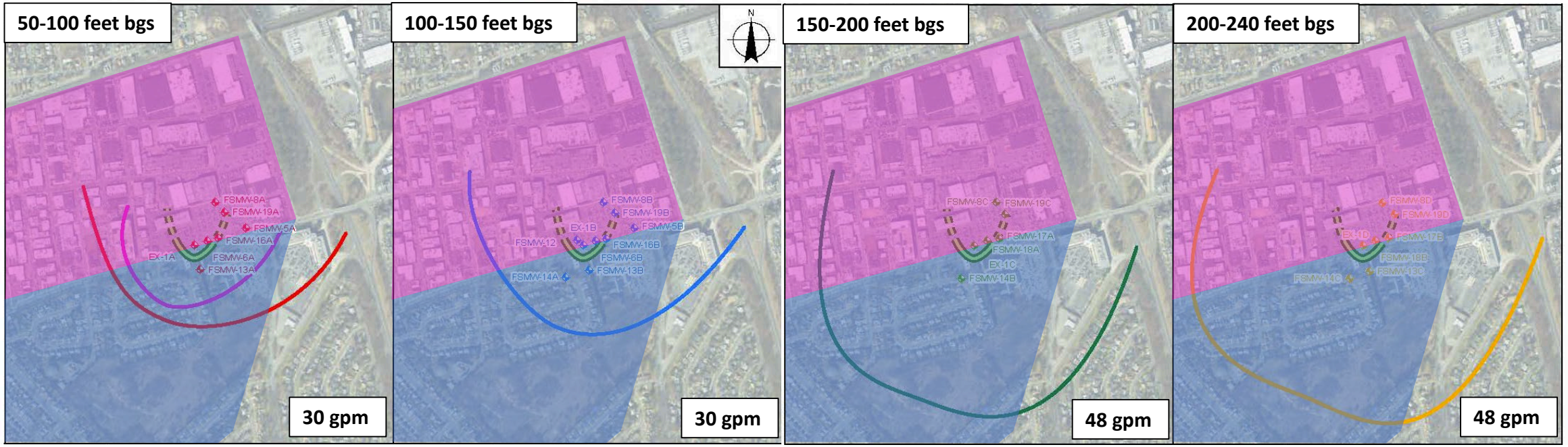


Geologic and Aquifer Information

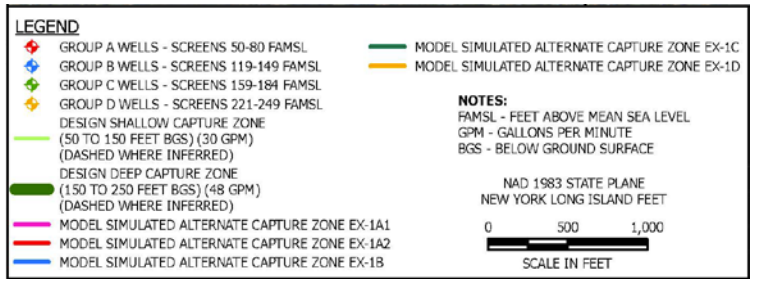




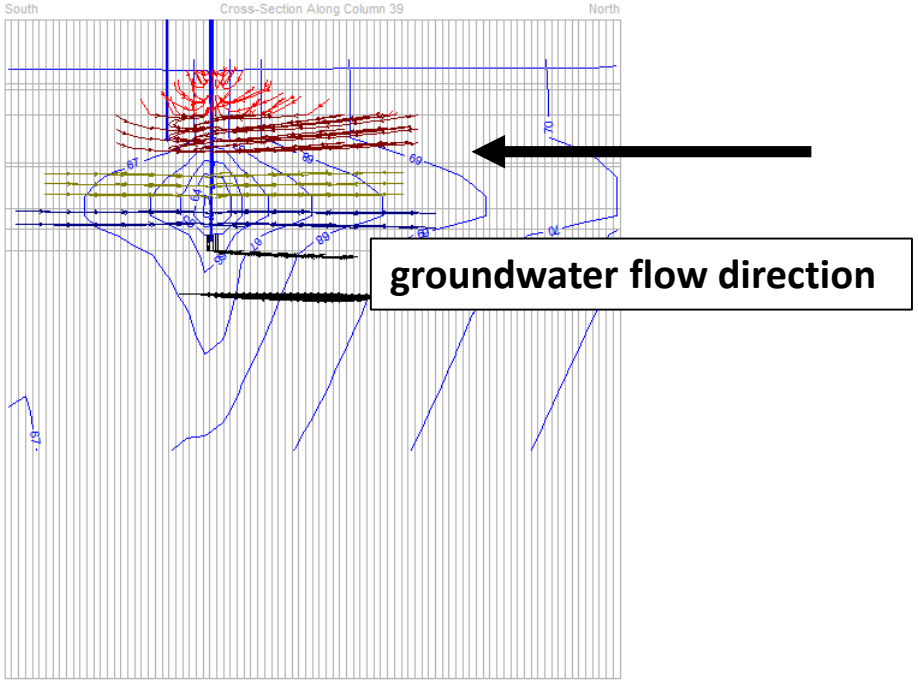
Geologic and Aquifer Information

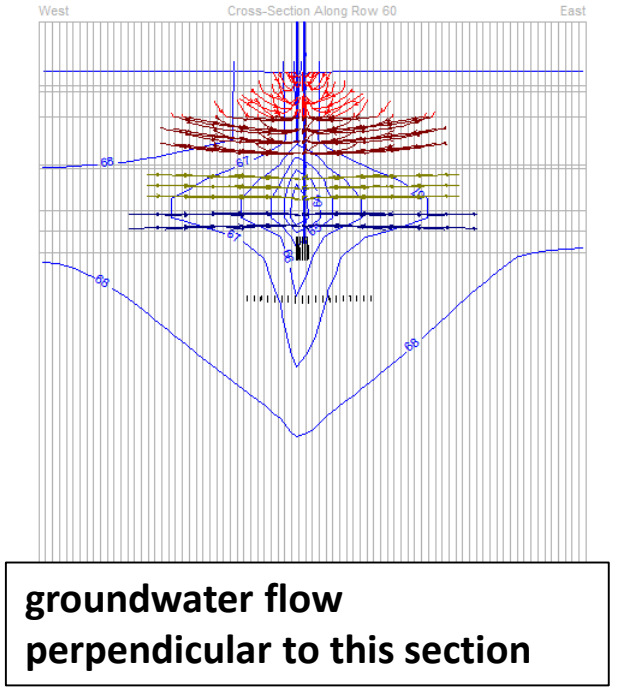


If pumping continues at design rates, after 20 years, this is the extent of capture we can expect.



Geologic and Aquifer Information



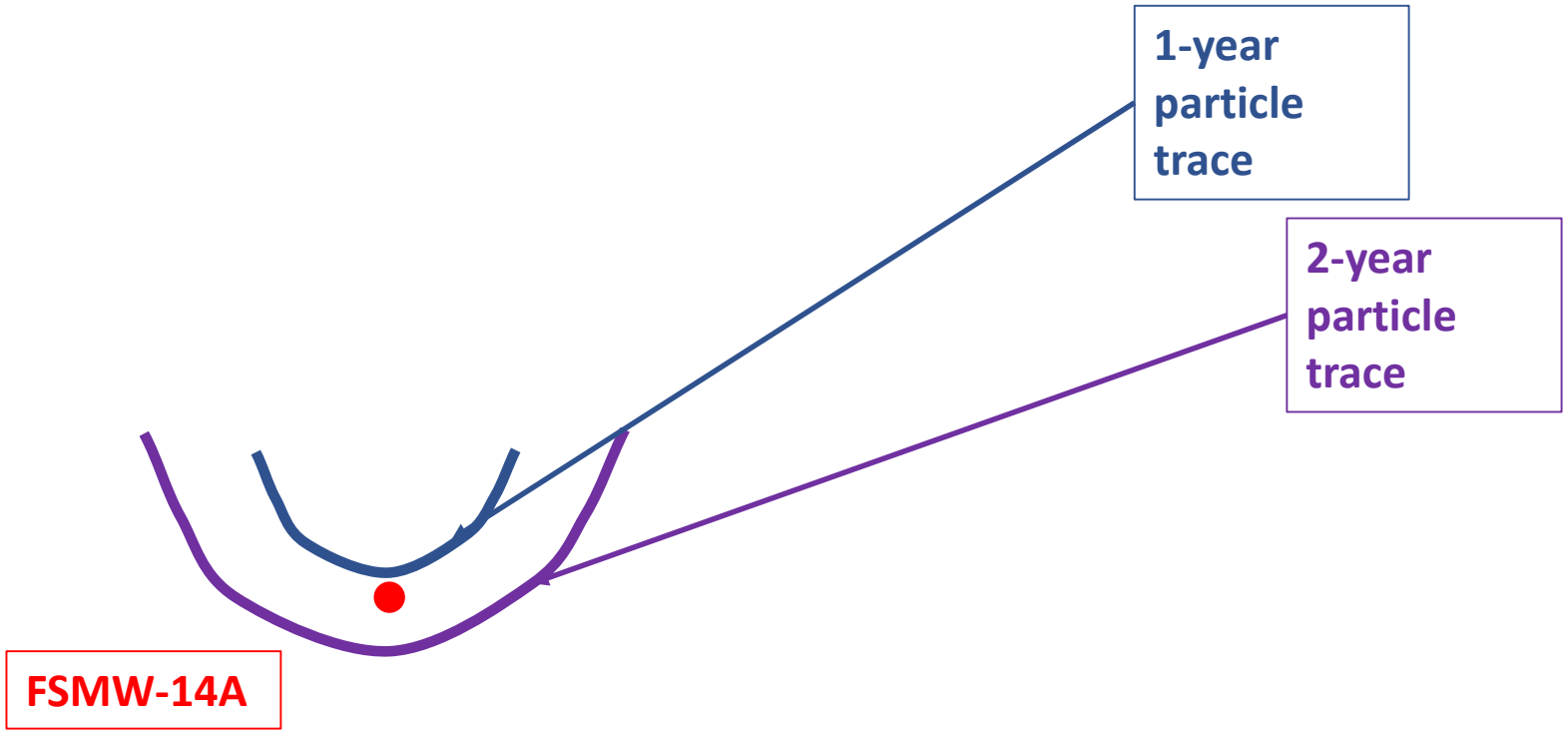


Geologic and Aquifer Information

- The report documenting the findings and recommended flow rates were submitted to NYSDEC on August 10, 2018; their review is ongoing.
- Because of this, the optimized flow rates have yet to be implemented on the Frost Street Sites, and pumping has been at or near design rates since completion of the test in June 2018, with some operational outages.
- At these higher design rates, the reduction of downgradient groundwater concentrations was seen in March 2019 and further confirmed with June 2019 data.

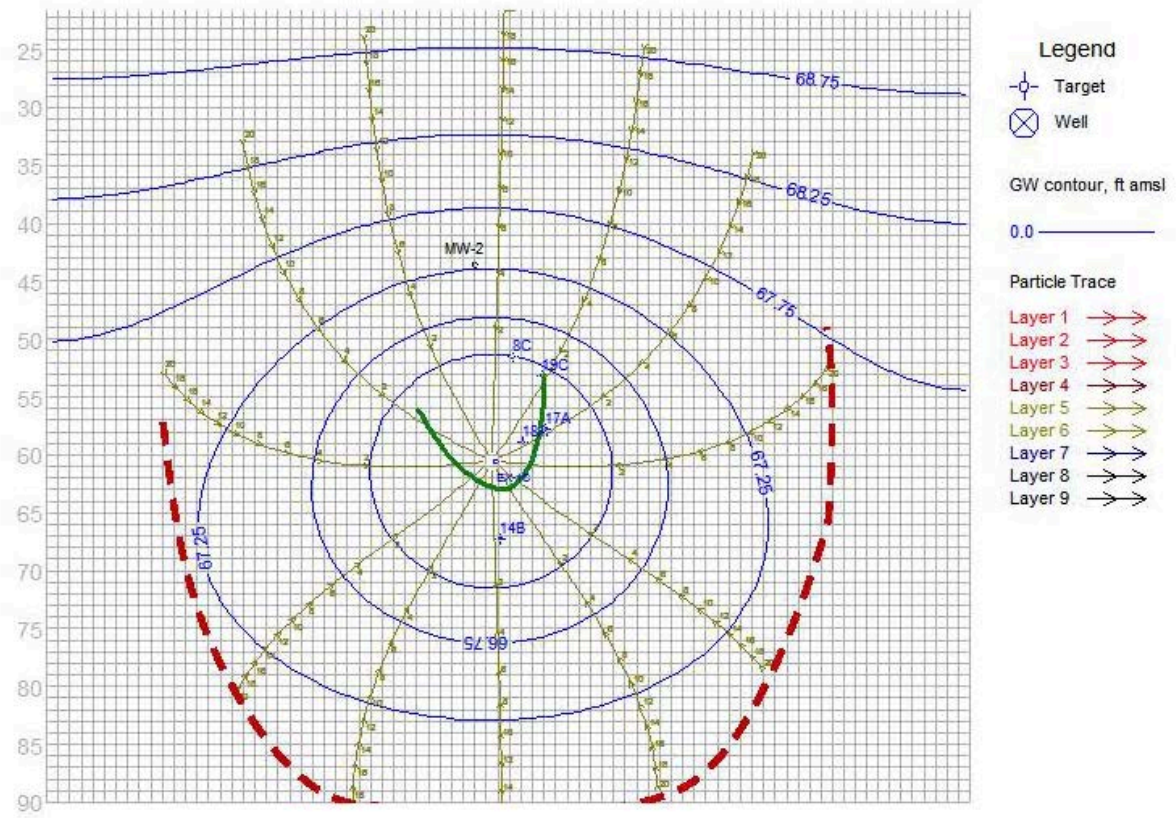
Geologic and Aquifer Information

Geologic and Aquifer Information

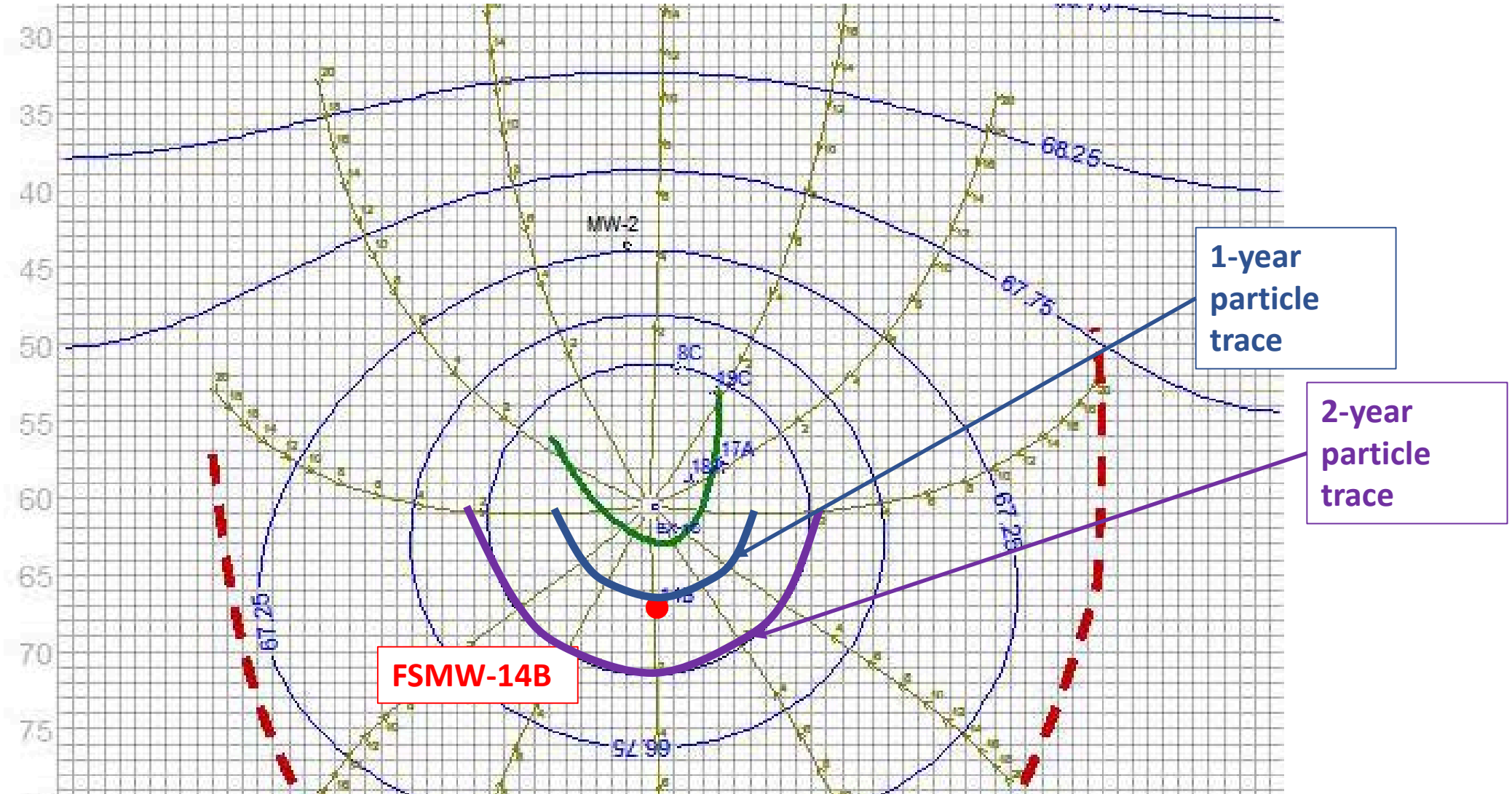


Geologic and Aquifer Information

Model Layer 6, Well EX-1C:

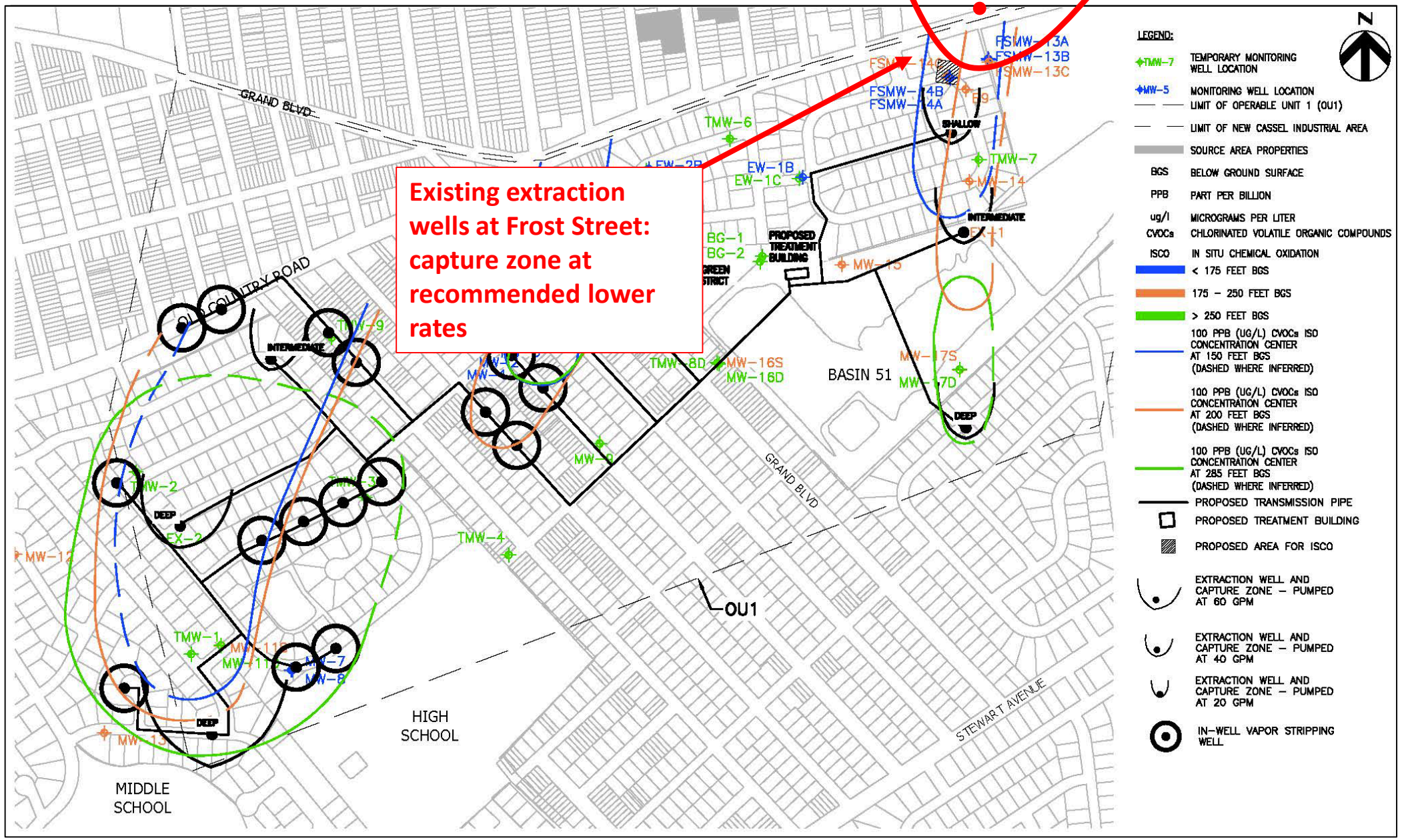


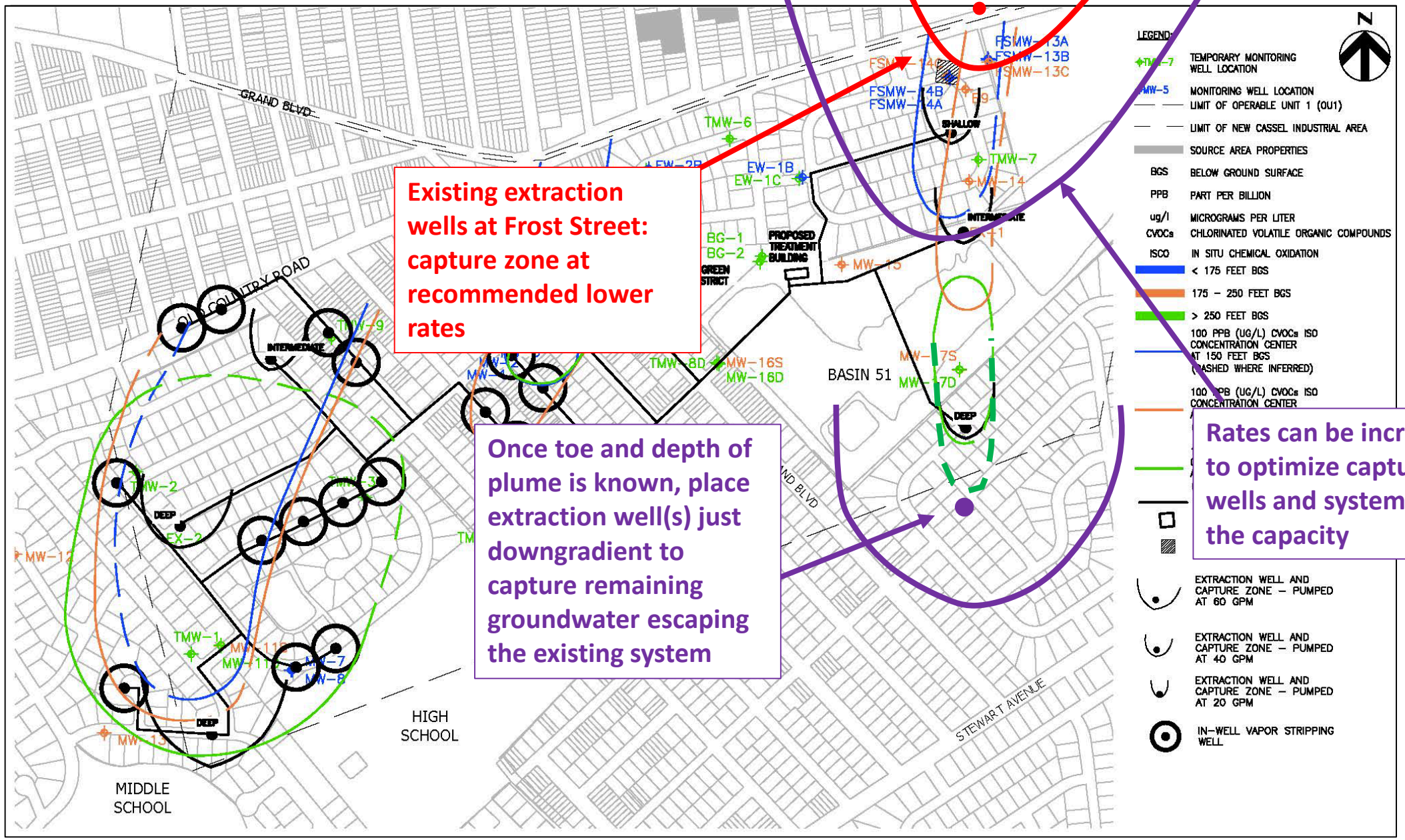
Geologic and Aquifer Information



What does this mean for U.S. EPA OU1?

- Model indicates effects of NYSDEC OU2 groundwater extraction system extend well into U.S. EPA OU1, overlapping the “shallow” and “intermediate” extraction well locations envisioned in the ROD (see next slide)
  - May be able to accomplish extraction at one or two locations (not three as originally envisioned)
  - Lower extraction rates may achieve ROD-capture zones
- Vertical component of pumping is larger than originally thought
  - Wells will likely not need to be screened over entire targeted extraction interval to capture that interval; depends on selected extraction rates and intervals
- Lower conductivity values, and stratification of those values, indicate slower rate of plume migration, but the toe of the Eastern Plume is likely south of the southern boundary of U.S. EPA OU1.


Existing extraction wells at Frost Street: capture zone at recommended lower rates
GRAND BLVD
COUNTRY ROAD
GRAND BLVD
STEWART AVENUE
BASIN 51
OU1
HIGH SCHOOL
MIDDLE SCHOOL
PROPOSED TREATMENT BUILDING
INTERMEDIATE
DEEP
SHALLOW
TMW-1
TMW-2
TMW-3
TMW-4
TMW-6
TMW-7
TMW-8D
TMW-9
MW-5
MW-7
MW-8
MW-9
MW-11S
MW-11D
MW-12
MW-13
MW-14
MW-15
MW-16S
MW-16D
MW-17S
MW-17D
EW-1B
EW-1C
BG-1
BG-2
EX-1
EX-2
FSMW-13A
FSMW-13B
FSMW-13C
FSMW-14A
FSMW-14B
LEGEND:
TMW-7 TEMPORARY MONITORING WELL LOCATION
MW-5 MONITORING WELL LOCATION
LIMIT OF OPERABLE UNIT 1 (OU1)
LIMIT OF NEW CASSEL INDUSTRIAL AREA
SOURCE AREA PROPERTIES
BGS BELOW GROUND SURFACE
PPB PART PER BILLION
ug/l MICROGRAMS PER LITER
CVOCs CHLORINATED VOLATILE ORGANIC COMPOUNDS
ISCO IN SITU CHEMICAL OXIDATION
< 175 FEET BGS
175 – 250 FEET BGS
> 250 FEET BGS
100 PPB (UG/L) CVOCs ISO CONCENTRATION CENTER AT 150 FEET BGS (DASHED WHERE INFERRED)
100 PPB (UG/L) CVOCs ISO CONCENTRATION CENTER AT 200 FEET BGS (DASHED WHERE INFERRED)
100 PPB (UG/L) CVOCs ISO CONCENTRATION CENTER AT 285 FEET BGS (DASHED WHERE INFERRED)
PROPOSED TRANSMISSION PIPE
PROPOSED TREATMENT BUILDING
PROPOSED AREA FOR ISCO
EXTRACTION WELL AND CAPTURE ZONE – PUMPED AT 60 GPM
EXTRACTION WELL AND CAPTURE ZONE – PUMPED AT 40 GPM
EXTRACTION WELL AND CAPTURE ZONE – PUMPED AT 20 GPM
IN-WELL VAPOR STRIPPING WELL
N


Existing extraction wells at Frost Street: capture zone at recommended lower rates
Once toe and depth of plume is known, place extraction well(s) just downgradient to capture remaining groundwater escaping the existing system
Rates can be increased to optimize capture; wells and system has the capacity
GRAND BLVD
COUNTRY ROAD
BASIN 51
HIGH SCHOOL
MIDDLE SCHOOL
STEWART AVENUE
PROPOSED TREATMENT BUILDING
LEGEND:
TEMPORARY MONITORING WELL LOCATION
MONITORING WELL LOCATION
LIMIT OF OPERABLE UNIT 1 (OU1)
LIMIT OF NEW CASSEL INDUSTRIAL AREA
SOURCE AREA PROPERTIES
BGS BELOW GROUND SURFACE
PPB PART PER BILLION
ug/l MICROGRAMS PER LITER
CVOCs CHLORINATED VOLATILE ORGANIC COMPOUNDS
ISCO IN SITU CHEMICAL OXIDATION
< 175 FEET BGS
175 – 250 FEET BGS
> 250 FEET BGS
100 PPB (UG/L) CVOCs ISO CONCENTRATION CENTER AT 150 FEET BGS (DASHED WHERE INFERRED)
EXTRACTION WELL AND CAPTURE ZONE – PUMPED AT 60 GPM
EXTRACTION WELL AND CAPTURE ZONE – PUMPED AT 40 GPM
EXTRACTION WELL AND CAPTURE ZONE – PUMPED AT 20 GPM
IN-WELL VAPOR STRIPPING WELL